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Leading in the Mathematics Classroom

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Introduction

Within the United Kingdom (UK) higher education sector there has been a considerable amount of debate in recent years about the level of quantitative and literacy skills exhibited by students on entry to university courses. Indeed the UK government commissioned two major reports on the development of skills at school level in the post-14 age range focussing specifically on the development of quantitative skills (Roberts 2002; Smith 2004) since there has been a sustained year-on-year fall in the numbers of students opting to study mathematics, science, and engineering subjects at degree level. Coupled with this reluctance of students to specialise in quantitative subjects is the associated problem that those students who study subjects for which mathematics is an enabling and supporting discipline (computing and information technology for example) are also exhibiting poor levels of ability in what are regarded as very basic mathematical skills. The ramifications of this in, for example, subjects related to healthcare and nursing can be huge since the consequences of mathematical error can be very serious (Glaister 2007). A third factor to add in to this mix is the very diverse nature of the student body now being admitted to universities. As the government has encouraged the expansion of the higher education sector, so institutions have 'broadened' their admissions policies so that students with a diverse collection of qualifications perhaps obtained over a number of years are gaining entry to courses that would probably have been denied to them ten years ago. Institutions have also looked to overseas students as another means of income generation and, of course, these students present yet more varied qualifications on entry.

Naturally, those of us teaching and supporting students studying mathematics at the university level have been constantly reviewing student performance and revising our mathematics curricula and teaching methods accordingly. Our goal is to develop learning and teaching approaches that address the mathematical needs of the wider programme of studies, engage the very good students and yet allow the identification and subsequent support of the weaker ones. Much research has been undertaken in the area of mathematics support (Warwick 2007) from the perspective of learning and teaching, assessment, and curriculum design (i.e. the process of education) yet there seems to have been very little consideration of how learning in the classroom is effectively led rather than just managed. Speaking with my faculty colleagues about their teaching of mathematics (and indeed of other subjects too) I hear a great deal about the design of lectures and seminars and the management of taught sessions, assessments etc. but very rarely is the idea of providing classroom leadership for students addressed.

Leadership in the Classroom

My own teaching predominantly involves modules taught to first year students studying for a degree in computing or business information technology. The profile of students joining these degree courses is very varied, with large numbers of students from outside the UK, and many mature students although they are all expected to have a level of mathematics equivalent to the UK General certificate of Secondary Education for which final examinations are taken at the age of 16. When students attend my

first year mathematics module I generally find that there are a significant number of students for whom the study of mathematics may have been an unpleasant experience in the past. Levels of confidence in using mathematics among these students are generally low and so I see my role as their teacher as not just organizing, planning, and controlling classes-attributes of class management-but of motivating, inspiring, and galvanising the students into having a positive and confident approach to the application of mathematics and creating expectations of success among them. These are the attributes of leadership and they seem to be rarely, if ever, addressed in staff development programmes. University teachers instead are expected to pick up these skills as they go along and, unfortunately, students tell of teachers who never seem to be able to master these skills and their lectures are poorly attended.

Experiential Learning

The mathematics classes that I teach have a format that avoids the use of large, formal, impersonal, set-piece lectures which concentrate on running through chunks of mathematical theory with the odd worked example thrown in. Instead, I try in my classes to encourage the students to undertake experiential learning. By this I mean that the weekly two-hour session will be to a small group of students (no more than 20), and will have a broken lecture style with some new material presented and developed with worked examples and exercises for the students interspersed at regular intervals. Students then have a set of exercises to try on their own (either towards the end of the scheduled class or outside of class time) and further directed reading through which they gain experience of using the mathematical ideas introduced. At the beginning of the next class there is a brief review of the previous session in which students can feed back their experiences, ask questions, seek clarifications and reflect on their success or otherwise in their attempts to use the material developed in the previous class. This approach follows the classic Kolb model of experiential learning (Kolb 1984) which is outlined in Figure 1.

Inherent in the development of Kolb's work is the notion that learners have particular strengths when working through the learning cycle and learners will often have a preferred learning style which Kolb describes in relation to a perception continuum (are learners 'feelers' or 'thinkers') and a processing continuum (do learners prefer 'doing' or 'watching'). Thus classroom activity requires the ability to deal with the differing preferred learning styles of the students and also to lead students through the stages of the learning cycle. The class tutor needs, therefore, to have an

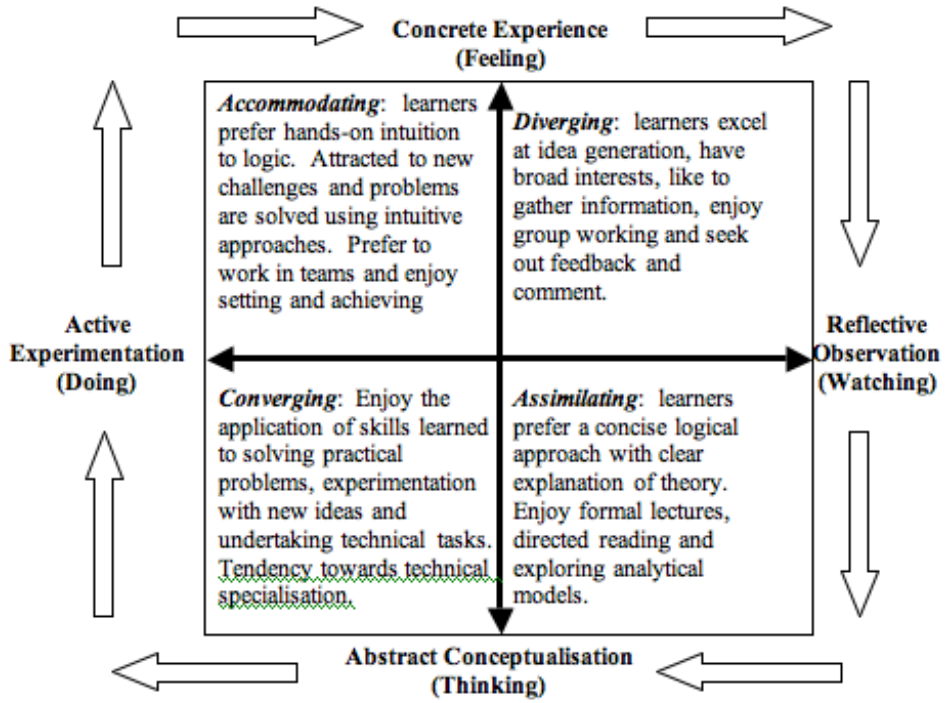

Figure 1: Kolb's Experiential Learning Cycle and Embedded Styles

ability to adapt the style of
leadership to the learning activity being performed and to the individual student requirement. This type of situational leadership flexibility has been described in the literature quite extensively and here we concentrate on the classic situational leadership model of Hersey and Blanchard (Hersey 1984; Hersey and Blanchard 1999) although others could be equally well applied (Goleman 2002).

The Hersey and Blanchard model of leadership has been used to some effect within educational settings (Hersey, Angelini and Carakushansky 1982) but despite the promising results of such studies little seems to exist in the recent learning and teaching literature that examines the application of leadership skills within the mathematics classroom.

Blanchard's Situational Leadership Model and Experiential Learning

This classic model dates from the late 1970s and characterizes leadership style in terms of the amount of direction and support provided by the leader. There are four styles of leadership described. The directing style requires the leader to give very clear guidance to followers, there is no discussion or debate. In this style there is a high level of direction but little support offered. The coaching style on the other hand combines high levels of direction with high levels of support for followers. There is clear leadership but also a two-way flow of ideas and discussion. Reducing the level of direction but maintaining a high level of support produces the supporting style in which the leader facilitates and takes part in discussion but control is generally with the followers. Finally, with low levels of direction and support we have the delegating style of leadership in which control is maintained by followers who also decide when and if to involve the leader in discussion.

If we relate this to the model of experiential learning then we find that the various stages of learning require different styles of leadership. This relationship is described in Figure 2.

I would generally regard my teaching of a new mathematical topic to commence the learning cycle at the abstract conceptualisation (thinking) stage in which new mathematical material, theory and method, are introduced to the students. The cycle can in fact be entered at any stage so long as the correct order of activities is observed. This entry stage quite clearly relates to the directive leadership style in which information flow is largely one-way (from teacher to student) and heavily directed with little support required. This would correspond to the traditional lecture and worked example element of the class.

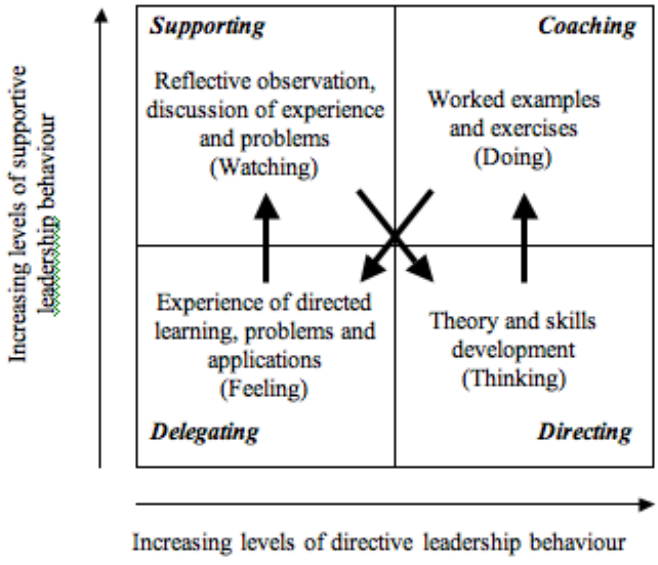

Figure 2: A Cycle of Experiential Learning and Leadership

From this we move to the active experimentation part of the cycle in which students are encouraged to try worked questions and new problems on their own but as part of the broken lecture and under the close scrutiny on the teacher. This we have an increased support role but still considerable direction required. We

have now moved to a coaching leadership style in which the leader is defining tasks and what needs to be done but seeks feedback from students and communication is very much more two-way.

The final part of the class allows students the freedom to work on the tutorial questions and these they can take away with them. They will also, of course, be applying the mathematics in the other related modules they are studying. Here, the leadership style required is the delegated style since the control of learning is now with the student who decides whether or not to involve the teacher (perhaps by requesting some support outside of class time in person or by email, using the virtual learning environment for support and so on).

At the start of the following class, students reflect on their work which is an activity led by the teacher in the supporting leadership style. No directive behaviour is required but the teacher facilitates the discussion and although the students provide the content of the discussion the tutor will ultimately move the class towards the presentation of more new material and move back to the directive leadership style.

In this way the leadership styles adapt as the stages of the cycle evolve. On an individual student level, the teacher must also be prepared to move between different leadership styles depending on the requirements of the student i.e. depending on the balance of supportive or directive behaviour required in the individual case.

Conclusion

It seems unfortunate that when faculty are discussing the staff development sessions required for the coming semester, there is much talk around learning and teaching, assessment and curriculum design as potential topics. There are also materials available for developing teacher's management and administrative skills in relation to their teaching but rarely is leadership mentioned. It is often assumed, in my experience, that leadership training is something that is given high priority in the private sector or that might be relevant to faculty deans and other members of the university senior management team. I would like to enter a plea for leadership skills to be discussed at all levels within a teaching institution and in particular for teachers to be able to provide their students with genuine leadership in subject areas such as mathematics where there is often fear and anxiety among students.

The UK student population is becoming ever more diverse and with demographic predictions indicating falls in the number of 14-19 year olds within the UK population but increases in the middle-aged and over 60 population segments (Hopkin 2008) it is clear that universities will be broadening access even more over the next 20 years. Managing such diversity is something that institutions will generally support but developing leadership skills among faculty teaching staff is not so obviously supported and surely a good teacher is also an effective leader. I can't help but feel that an opportunity is being lost.

References

Glaister, K. 2007. The presence of mathematics and computer anxiety in nursing students and their effects on medication dosage calculations. Nursing Education Today, 27(4): 341-347.

Goleman, D. 2000. Leadership that gets results. Harvard Business Online, Mar.-Apr. 2002. Harvard

Business School Publishing Corporation.

Hersey, P. 1984. The situational Leader. Escondido CA: Centre for Leadership Studies.

Hersey, P., A. Angelini, and S. Carakushansky. 1982. The impact of situational leadership and classroom structure on learning effectiveness. Group and Organisation Management, 7(2): 216-224.

Hersey P. and K. Blanchard. 1999. Leadership and the one minute manager. William Morrow.

Hopkin, D. 2008. The 21st century learner. Presented at the London South Bank University Learning and Teaching Conference, London, January 2008.

Kolb, D. A. 1984. Experimental learning: experience as the source of learning and development. Englewood Cliffs NJ: Prentice Hall

Roberts, G. 2002. SET for success: the supply of people with science, technology, engineering and mathematical skills. Report commissioned by the UK Government. UK: The Stationery Office Limited.

Smith, A. 2004. Making mathematics count. Report commissioned by the UK Government. UK: The Stationery Office Limited.

Warwick, J. 2007. A pilot study in the application of the AHP to predict student performance. Problems, Resources, Issues in Mathematics Undergraduate Studies, 17(2):181-194.

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